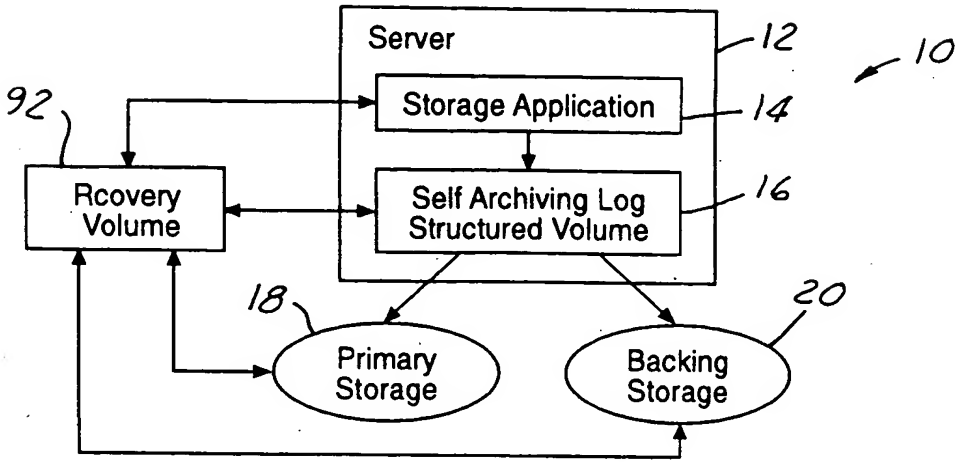

Server
12
10
Storage Application
14
92
Rcovery Volume
Self Archiving Log Structured Volume
16
18
20
Primary Storage
Backing Storage

FIG. 1

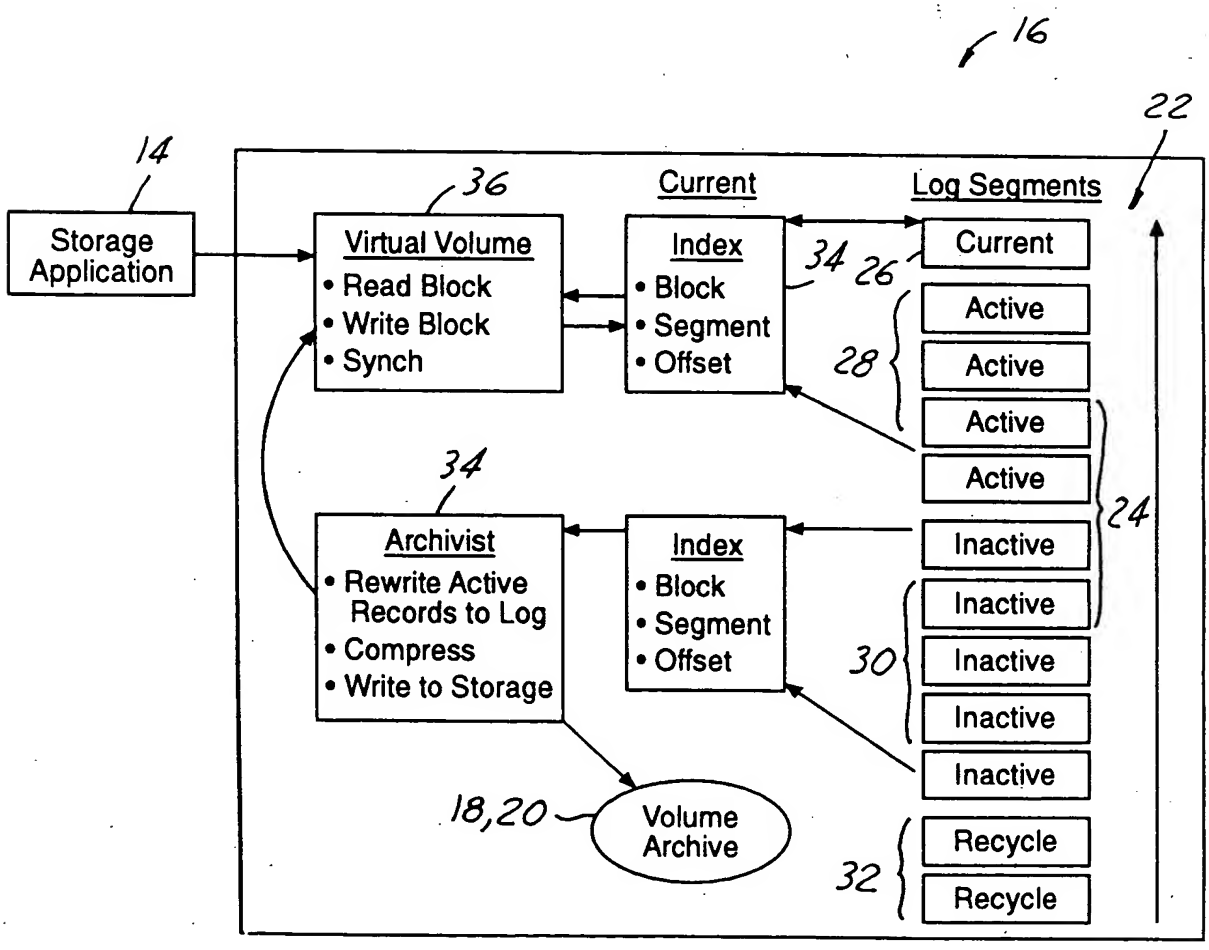

16
22
14
Storage Application
36
Virtual Volume
• Read Block
• Write Block
• Synch
Current
Log Segments
Index
• Block
• Segment
• Offset
34
26
Current
Active
Active
Active
Active
28
24
34
Archivist
• Rewrite Active Records to Log
• Compress
• Write to Storage
Index
• Block
• Segment
• Offset
Inactive
Inactive
Inactive
Inactive
30
18,20
Volume Archive
Recycle
Recycle
32

FIG. 2

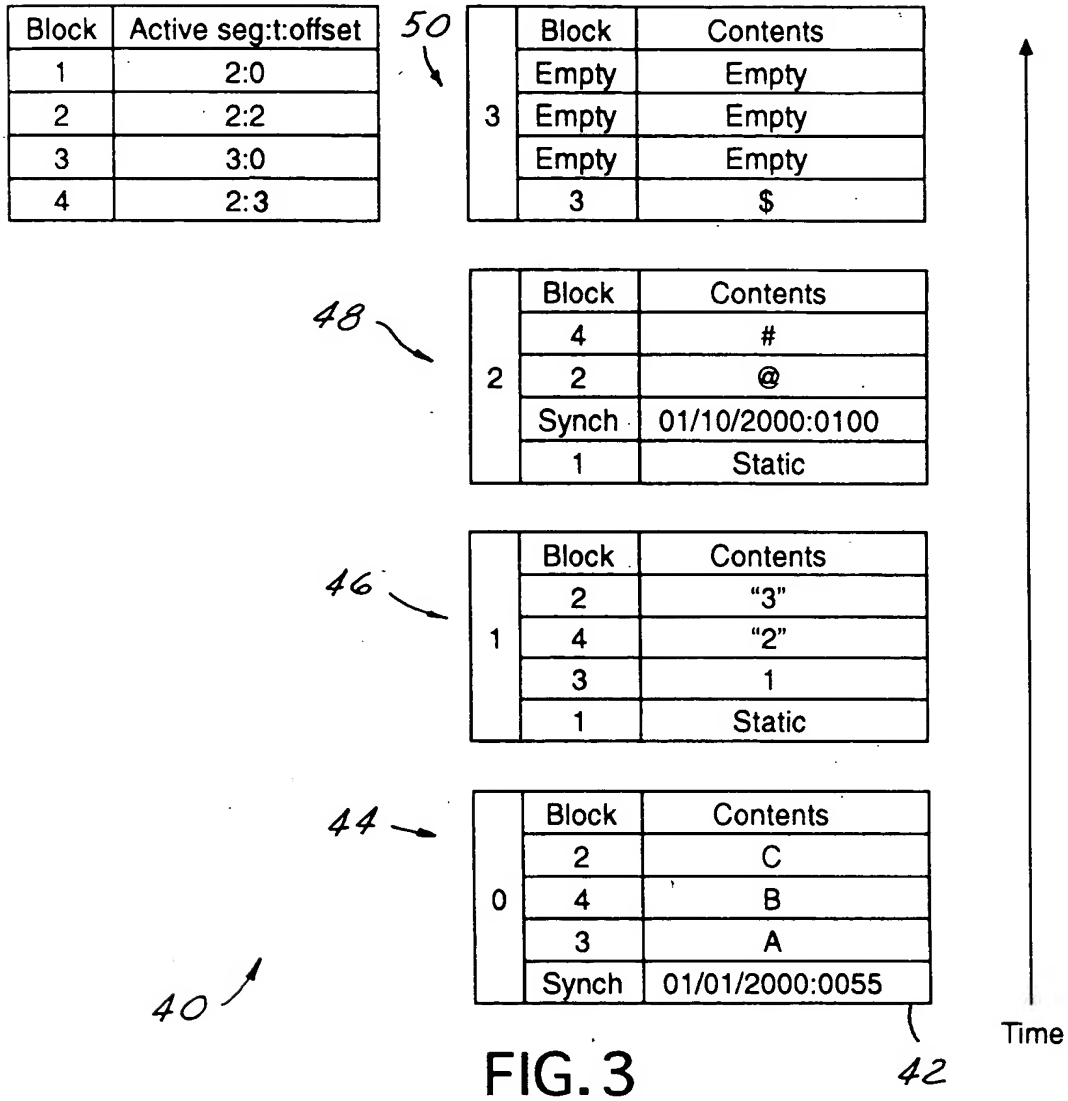
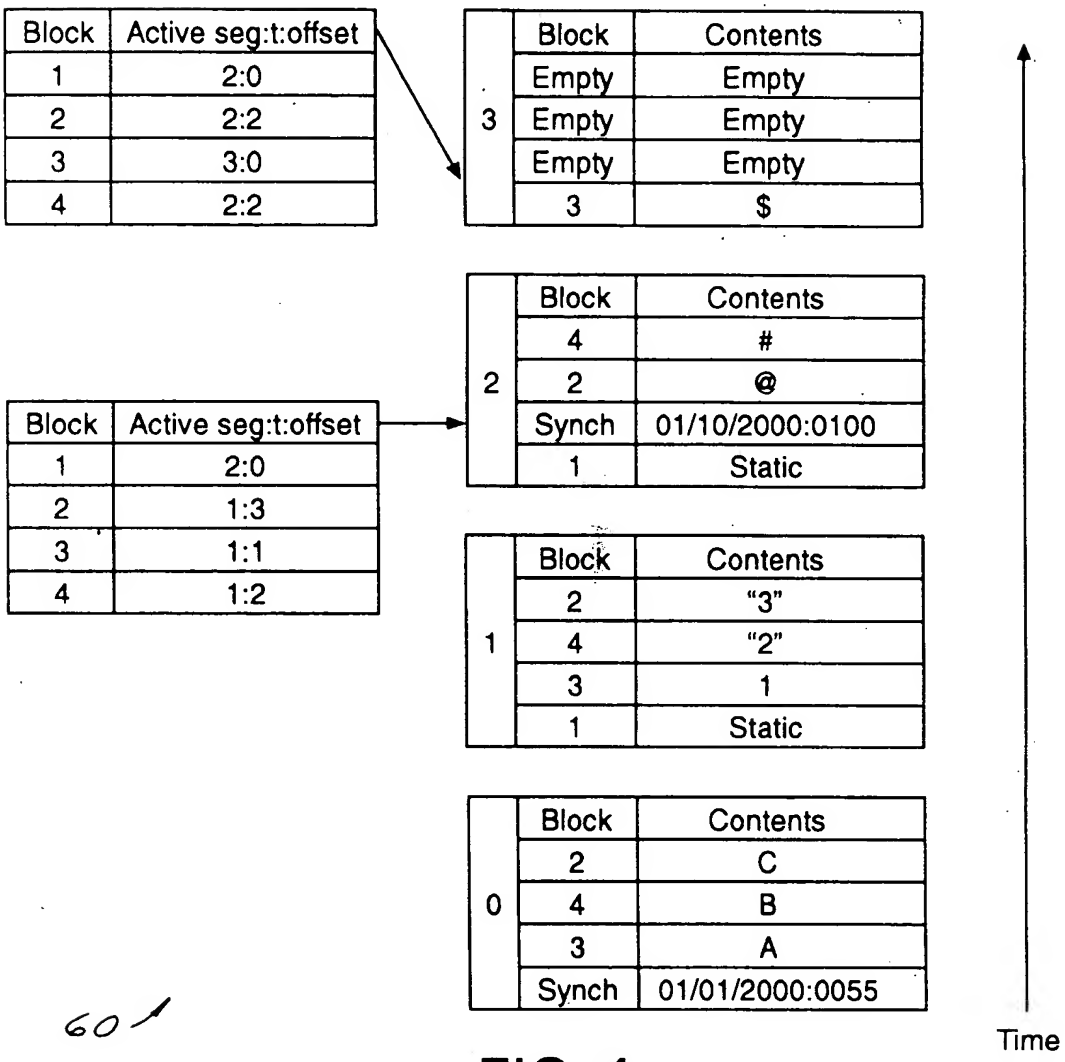

Block
Active seg:t:offset
1
2:0
2
2:2
3
3:0
4
2:3
50
3
Block
Contents
Empty
Empty
Empty
Empty
Empty
Empty
3
$
48
2
Block
Contents
4
#
2
@
Synch
01/10/2000:0100
1
Static
46
1
Block
Contents
2
"3"
4
"2"
3
1
1
Static
44
0
Block
Contents
2
C
4
B
3
A
Synch
01/01/2000:0055
40
42
Time

FIG. 3


Block
Active seg:t:offset
1
2:0
2
2:2
3
3:0
4
2:2
3
Block
Contents
Empty
Empty
Empty
Empty
Empty
Empty
3
$
Block
Active seg:t:offset
1
2:0
2
1:3
3
1:1
4
1:2
2
Block
Contents
4
#
2
@
Synch
01/10/2000:0100
1
Static
1
Block
Contents
2
"3"
4
"2"
3
1
1
Static
0
Block
Contents
2
C
4
B
3
A
Synch
01/01/2000:0055
Time

601

FIG. 4

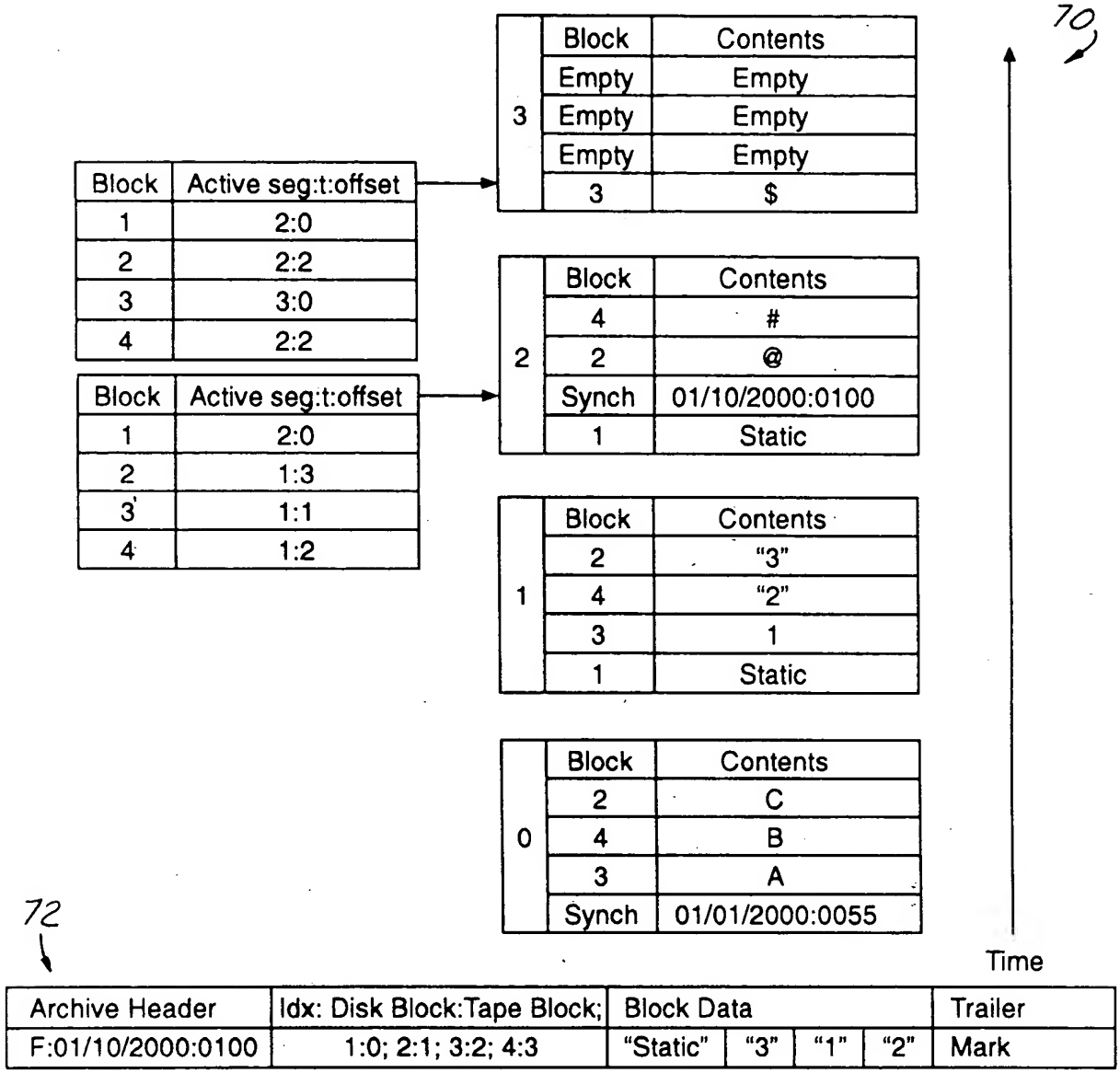

70
Block
Active seg:t:offset
1
2:0
2
2:2
3
3:0
4
2:2
Block
Active seg:t:offset
1
2:0
2
1:3
3
1:1
4
1:2
3
Block
Contents
Empty
Empty
Empty
Empty
Empty
Empty
3
$
2
Block
Contents
4
#
2
@
Synch
01/10/2000:0100
1
Static
1
Block
Contents
2
"3"
4
"2"
3
1
1
Static
0
Block
Contents
2
C
4
B
3
A
Synch
01/01/2000:0055
Time
72
Archive Header
Idx: Disk Block:Tape Block;
Block Data
Trailer
F:01/10/2000:0100
1:0; 2:1; 3:2; 4:3
"Static"
"3"
"1"
"2"
Mark

FIG. 5

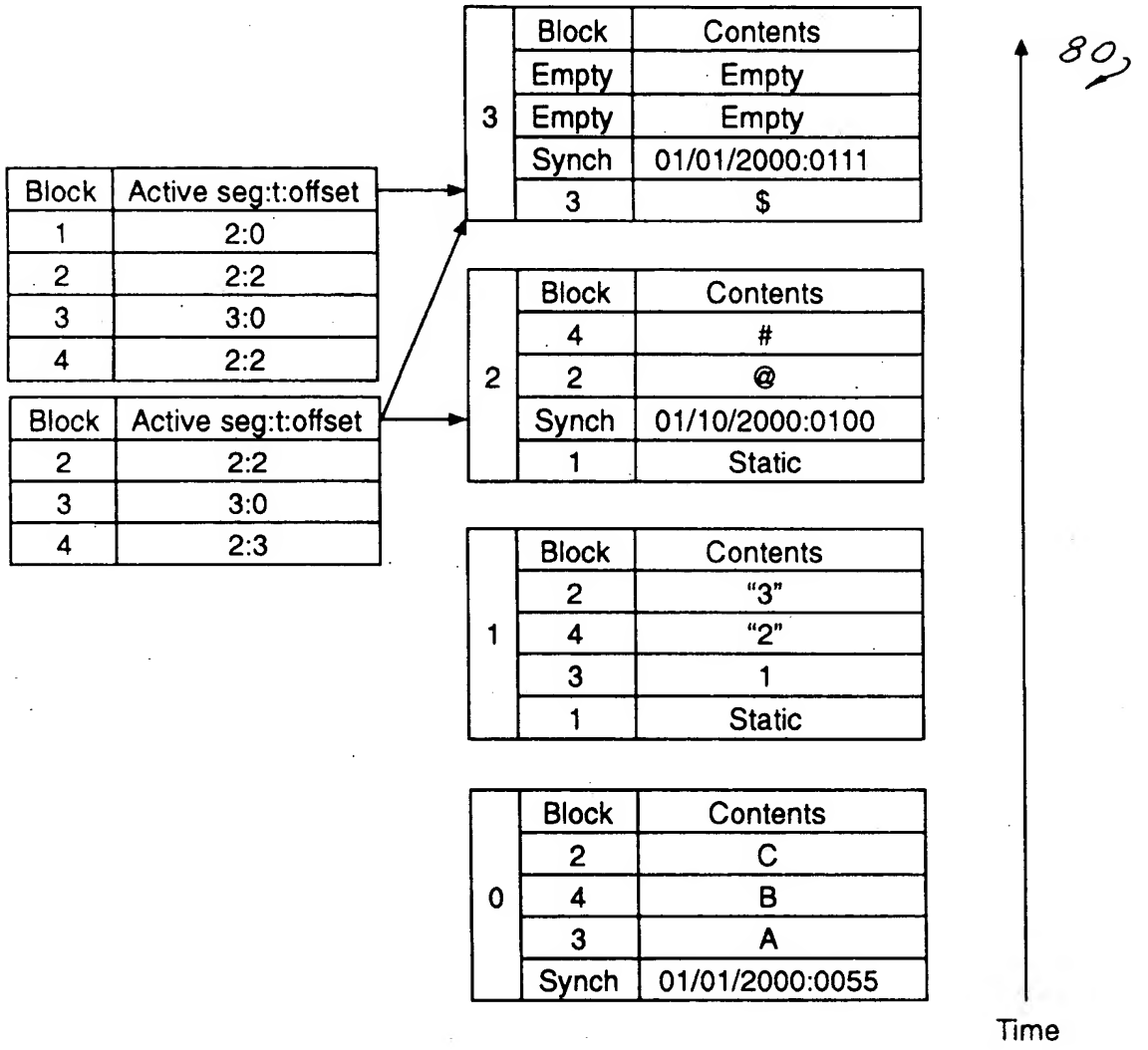

80
Block
Active seg:t:offset
1
2:0
2
2:2
3
3:0
4
2:2
Block
Active seg:t:offset
2
2:2
3
3:0
4
2:3
3
Block
Contents
Empty
Empty
Empty
Empty
Synch
01/01/2000:0111
3
$
2
Block
Contents
4
#
2
@
Synch
01/10/2000:0100
1
Static
1
Block
Contents
2
"3"
4
"2"
3
1
1
Static
0
Block
Contents
2
C
4
B
3
A
Synch
01/01/2000:0055
Time
Archive Header
Index
Block Data
Trailer
I:01/01/2000:0111 - 01/01/2000:0100
2:0; 3:1; 4:2
"@"
"$"
"#"
Mark
82

FIG. 6

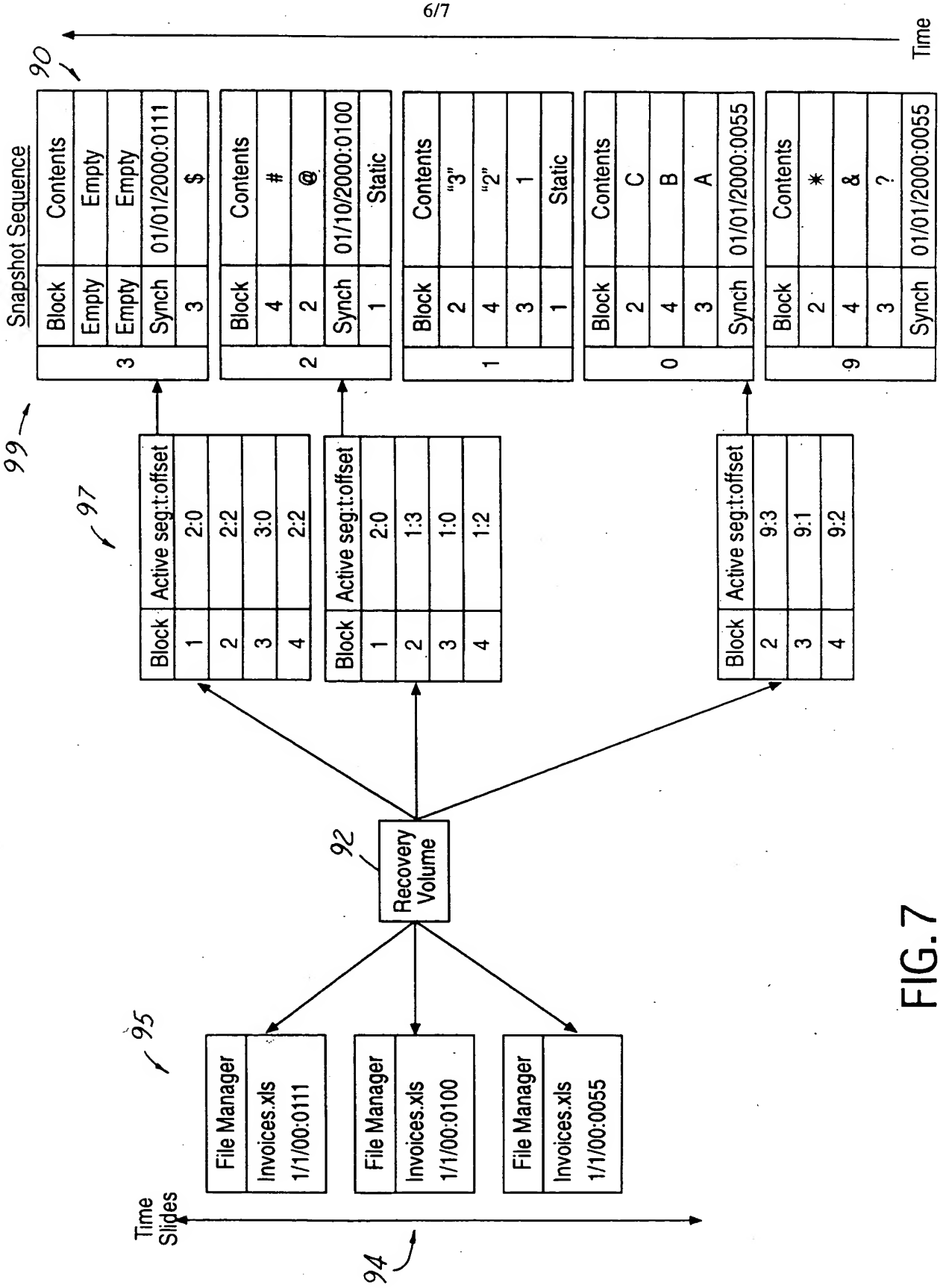

Time
90
Snapshot Sequence
Block | Contents
3 | Empty | Empty | Synch | 3 | Empty | Empty | 01/01/2000:0111 | $
2 | Block | Contents | 4 | # | 2 | @ | Synch | 1 | 01/10/2000:0100 | Static
1 | Block | Contents | 2 | "3" | 4 | "2" | 3 | 1 | 1 | Static
0 | Block | Contents | 2 | C | 4 | B | 3 | A | Synch | 01/01/2000:0055
9 | Block | Contents | 2 | * | 4 | & | 3 | ? | Synch | 01/01/2000:0055
99
97
Block | Active seg:t:offset
1 | 2:0
2 | 2:2
3 | 3:0
4 | 2:2
Block | Active seg:t:offset
1 | 2:0
2 | 1:3
3 | 1:0
4 | 1:2
Block | Active seg:t:offset
2 | 9:3
3 | 9:1
4 | 9:2
92
Recovery Volume
95
File Manager | Invoices.xls 1/1/00:0111
File Manager | Invoices.xls 1/1/00:0100
File Manager | Invoices.xls 1/1/00:0055
Time Slides
94

FIG. 7

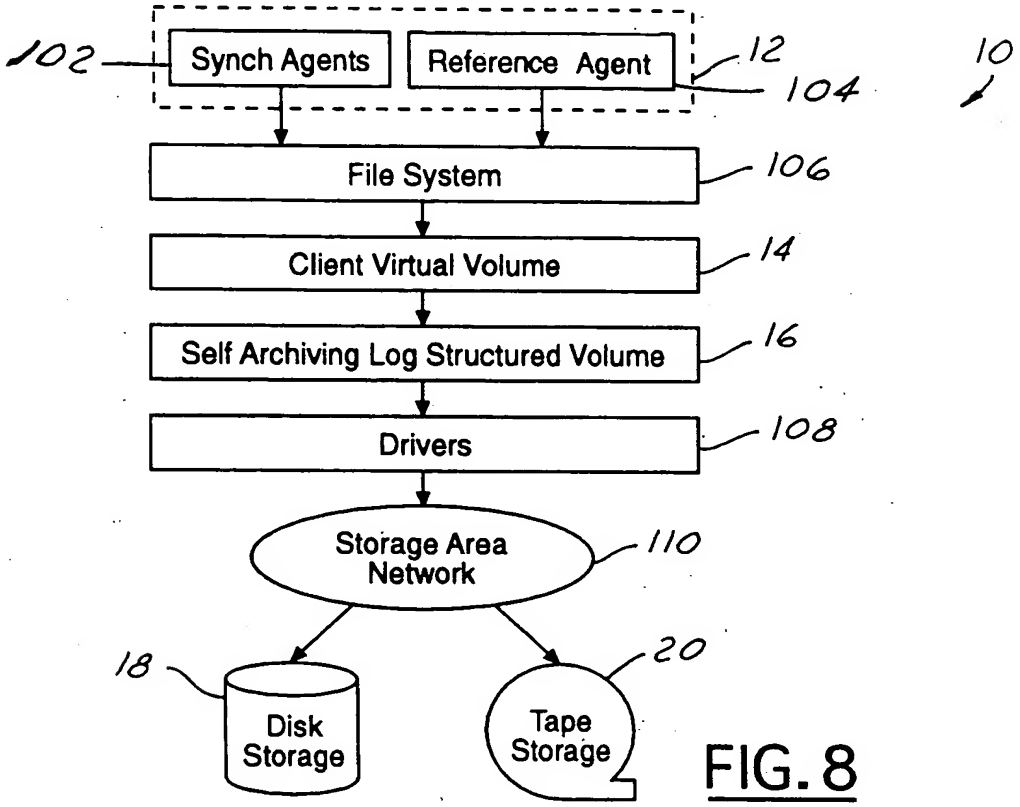

102
Synch Agents
Reference Agent
12
104
10
File System
106
Client Virtual Volume
14
Self Archiving Log Structured Volume
16
Drivers
108
Storage Area Network
110
18
Disk Storage
20
Tape Storage

FIG. 8

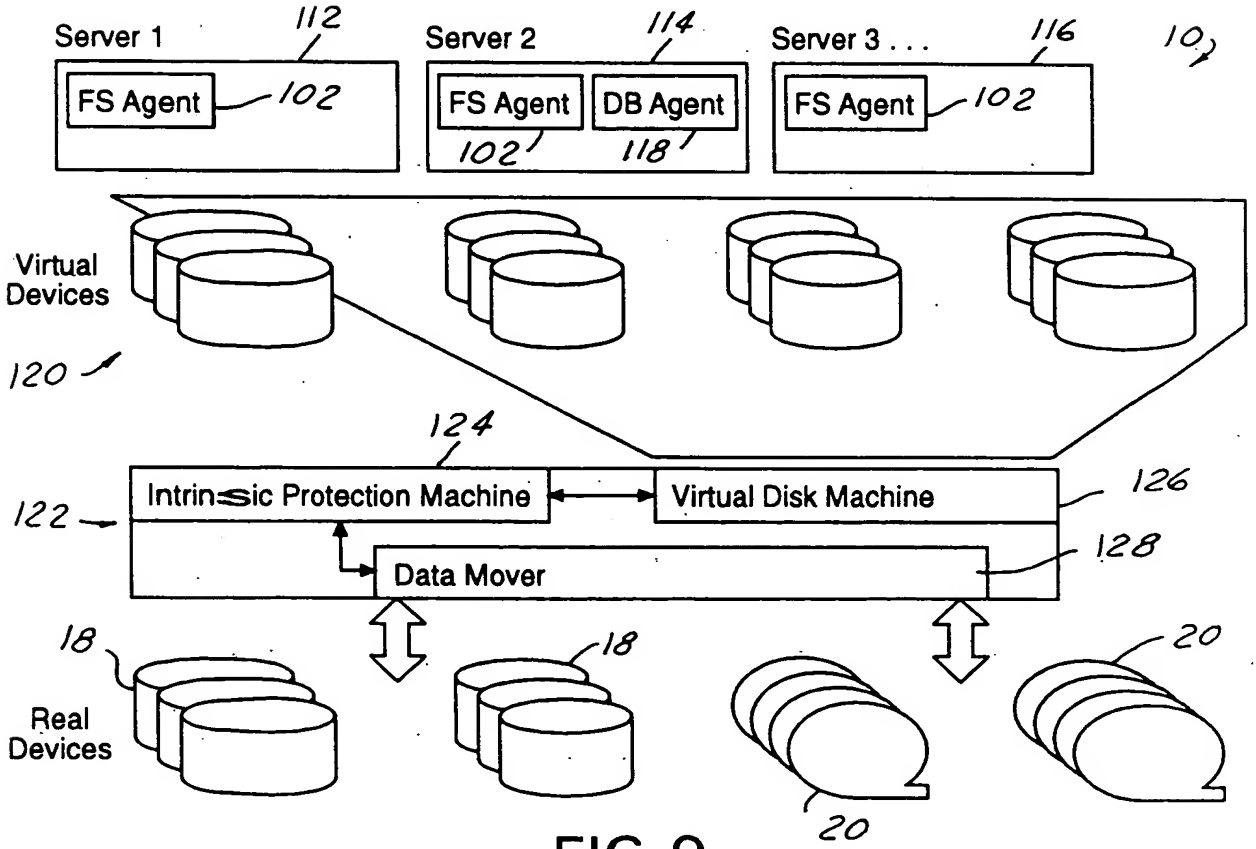

Server 1
112
FS Agent
102
Server 2
114
FS Agent
102
DB Agent
118
Server 3 . . .
116
FS Agent
102
10
Virtual Devices
120
124
Intrinsic Protection Machine
Virtual Disk Machine
126
122
Data Mover
128
18
Real Devices
18
20
20

FIG. 9